

any is again called to the very easy manner in which a large supply of germinated pollen was provided for the study here outlined. The same method has proved successful in several other cultures.

Fertilization of *Calopogon parviflorus* Lindl.¹

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While at Orlando, Florida, in February, 1887, I found this plant very common in pine barrens.

The flower is interesting from the fact that the ovary is not twisted, so that the labellum occupies the upper side and the column the lower. These parts are at right angles to each other, the labellum being erect and the column curving outward and a little downward. The labellum gradually narrows to a winged basal portion, on which it is hinged. In the wind it often bends forward: in old flowers it falls from its own weight and lies upon the column. In front it is furnished with a conspicuous crest of club-shaped hairs. From above the hairs increase in length so that their tips rise to about the same level. The lower project strongly from the labellum, and many of them are fused together, especially below. When the labellum is bent down upon the column the crest does not reach as far as the stigma. The stigma is at the summit of the column, and is covered with viscid matter. In a little pocket just under the stigma lies the anther, which is two-celled, each cell containing two pollen masses whose grains are lightly connected by threads.

Small bees, *Andrenidæ*, approaching the flower in front, light upon the crest, when the labellum bends suddenly, so that the dorsal surface of the insect comes down upon the column. The broad, slightly upturned wings of the column keep the body from passing to either side, and so require it to slip off the end. In doing this the body strikes the stigma and is smeared with viscid matter. The pressure of the insect upon the stigma starts the anther from the pocket, so that the ends of the pollen masses are exposed. As the body slips off the end of the column the exposed ends of the pollinia strike the part which is smeared with viscid matter from the stigma, and the pollinia are drawn out and cemented to

¹ Kindly determined by Dr. Sereno Watson. For an interesting account of the morphology of *Calopogon* and a figure of *C. pulchellus*, see "Goodale & Sprague," "Wild Flowers," pp. 73 and 85, and pl. xiv.

the exact spot which struck the stigma in the first place. When the insect visits another flower, the part to which the pollen is glued comes down upon the stigma.

Cross-fertilization results from the fact that the stigma is struck before the pollinia, from the startling action of the labellum, and from the fact that only two or three flowers are open at a time. Guignard's² opinion, that cross-fertilization is not so well assured as in *Pogonia*, no doubt, rests on an erroneous view of the floral mechanism.

There is no nectar. If there were any real source of attraction about the crest, small insects which are not heavy enough to depress the labellum would be the only ones to enjoy it undisturbed. The hairs of the crest look like a cluster of dehiscent stamens, for which, I think, they are mistaken by insects. If so, the flower is one of Sprengel's "Scheinsaftblumen," except that the attraction imitated is pollen instead of nectar. Specimens of two species of *Halictus*, which visited the flowers, had their pollen-carrying hairs well filled, showing that they were on pollen-collecting expeditions. On the other hand, butterflies, which do not visit flowers for pollen, paid no attention to the crest, but sought in vain for nectar near the center of the flower. Guignard³ saw a bumble-bee light upon the column of *C. pulchellus*, no doubt expecting to find nectar, while one which I saw pull down the labellum had pollen in her baskets and evidently mistook the hairs for stamens.

In regard to the source of attraction, Guignard⁴ says: "There is, indeed, no free nectar, but the basis of the lip and of the column, which are connate, are thickened around a small depression which seems to correspond to the spur of the other genera, and are as if swollen with juices. To insects knowing how to draw from this store the winged column offers a most convenient stage while sucking the sweets. Then the anther is behind them and the pollinia must become attached to their legs, as is the case with the milk-weed." But he did not see the thickened parts punctured by any insect, nor did he find pollinia on the legs of any. The thickened base of the lip seems to be intended to keep it from bending below the hinge, and that of the column to support the weight of an insect which falls upon it. From Guig-

² "Insects and Orchids," J. A. Guignard, 16th Annual Report Ent. Soc., Ontario, 1886, p. 43. In the 17th report of the same, p. 51, Guignard gives an interesting account of the fertilization of the *Cypripedium spectabile* by *Megachile melanophaea*.

³ Loc. cit. 39.

⁴ Loc. cit. 43.

nard's account, the labellum might as well have no hinge, and the crest would do as well if it were a bright spot on the surface.

The Rev. A. B. Hervey⁵ also takes it for granted that the pollinia are fastened to the under side of insects.

When I first noticed the curiously hinged and crested labellum it occurred to me that Mr. Darwin would say that here was the place to look for an explanation of the flower,⁶ and I soon formed the theory which I succeeded in verifying. On relating my observations to Professor Trelease, I found that he had held the same view of the flower, and had corresponded with Dr. Hermann Müller on the subject. At my request, Professor Trelease has furnished me with the following note: "Briefly, my idea of *Calopogon* was that the weight of the insect visitor must bend the labellum so as to bring the bee's back against the column, thus enabling it to effect pollination—a view that Hermann Müller wrote me was the only plausible one he could get from my sketches and notes: but it was never demonstrated in the field."

Calopogon is one of a few flowers which move the insect toward the stigma. In *Pterostylis*,⁷ the labellum flies up elastically and imprisons the visitor in the upper part of the flower, and the insect strikes the stigma in escaping.

There is no expenditure in keeping up a supply of nectar, and the flower, although requiring a smooth insect of a certain size and weight, suffers nothing from the visits of those it can not utilize.

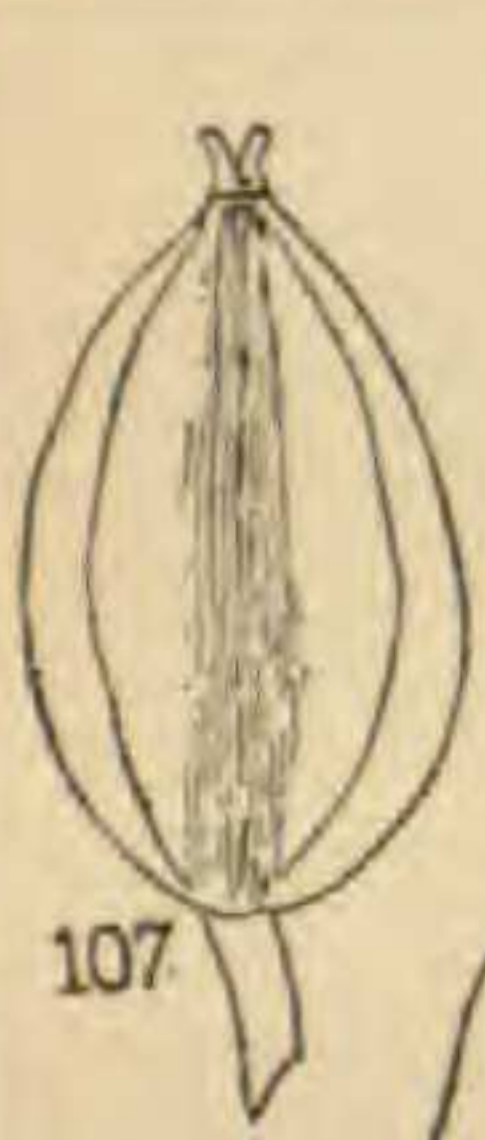
Then, there is no delay caused by the insect waiting to suck, but, as soon as it lights, it is thrown down against the stigma. This occurs so quickly that, while standing with net in hand, I have seen insects effect pollination and escape before I could catch them.

So many orchids fasten their pollinia upon the faces and tongues of insects that it is interesting to find one which applies them regularly to the first abdominal segment. If one wished to place the loose pollinia of *Calopogon* on some part of the bee where it would be least likely to be disturbed by the bee itself, or by surrounding objects, he could not find a better spot than the place where the flower is adapted to

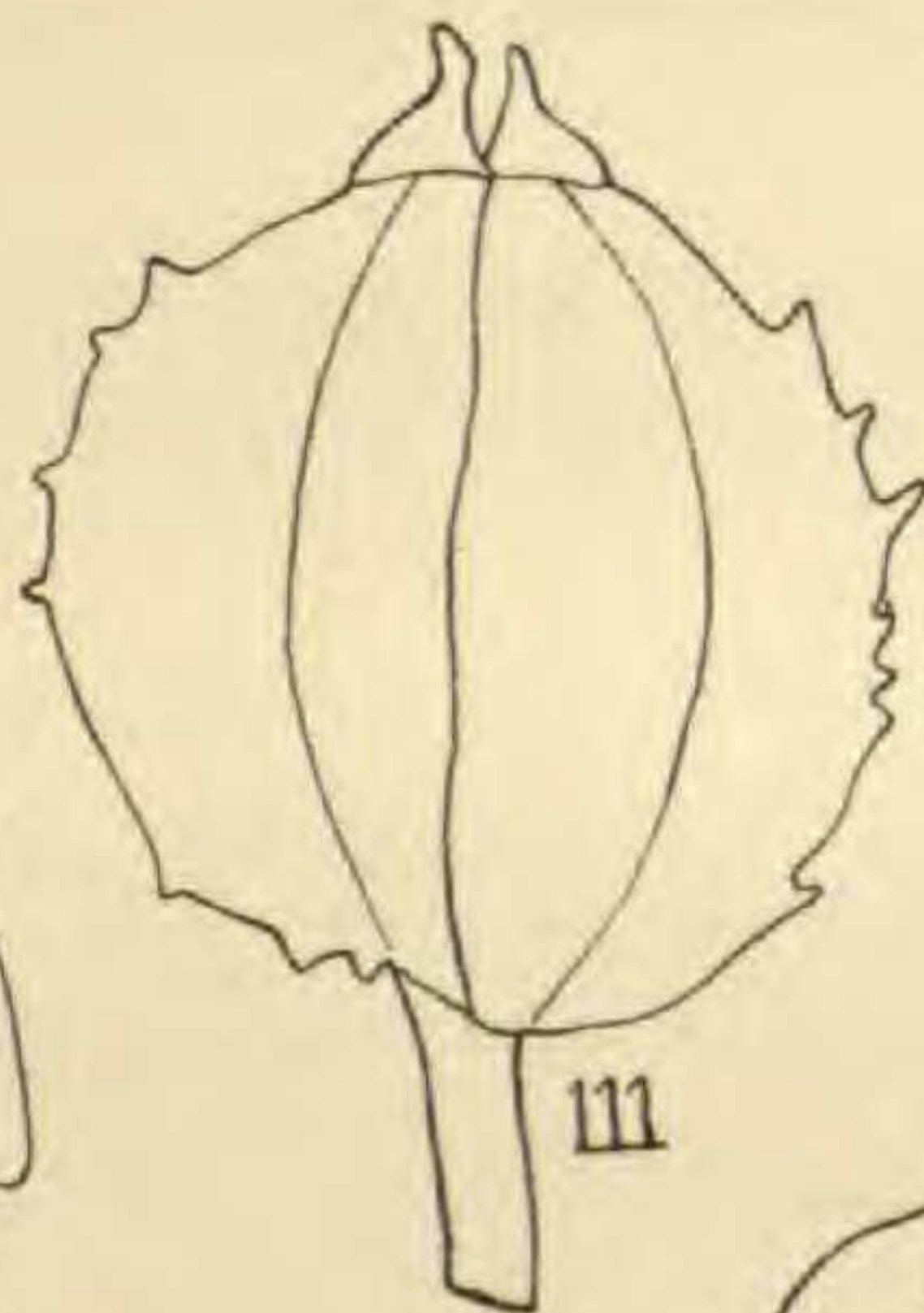
⁵ "Wayside Flowers and Ferns."

⁶ Under *Mormodes ignea*, "Fertilization of Orchids," 216, Mr. Darwin says: "At the close of the twelfth trial I was in despair. The strange position of the labellum, perched on the summit of the column, ought to have shown me that here was the place for experiment. I ought to have rejected the notion that the labellum was thus placed for no good purpose. This plain guide was overlooked, and for a long time I completely failed to understand the structure of the flower."

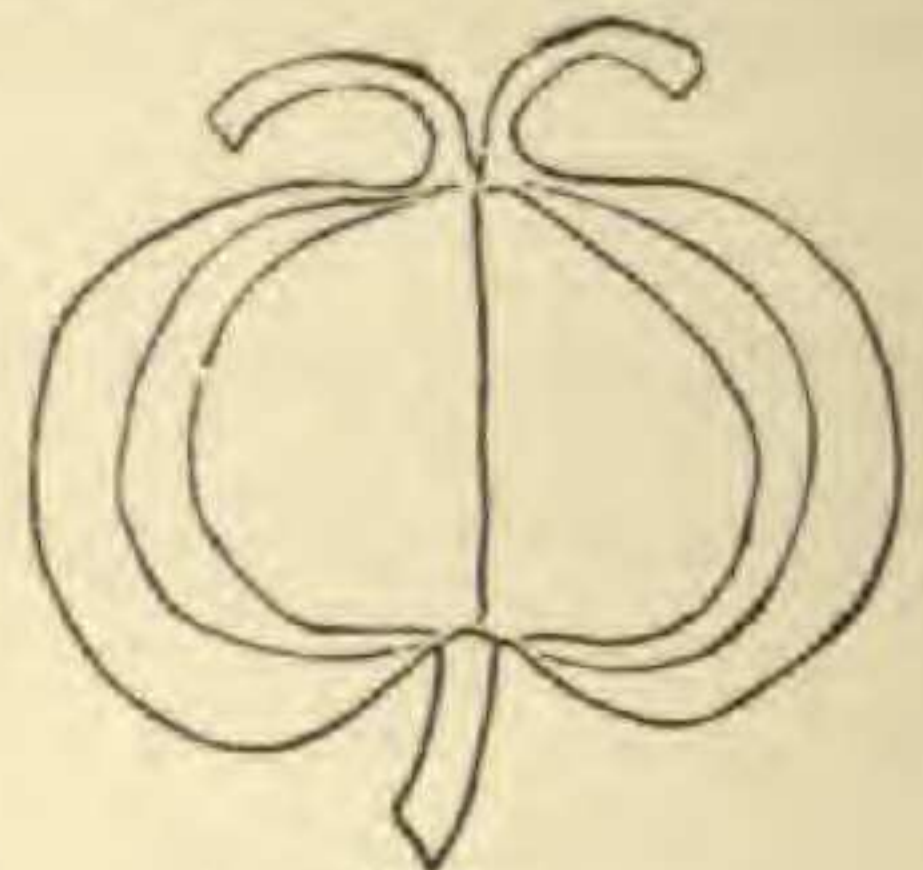
⁷ Darwin, loc. cit. 86.



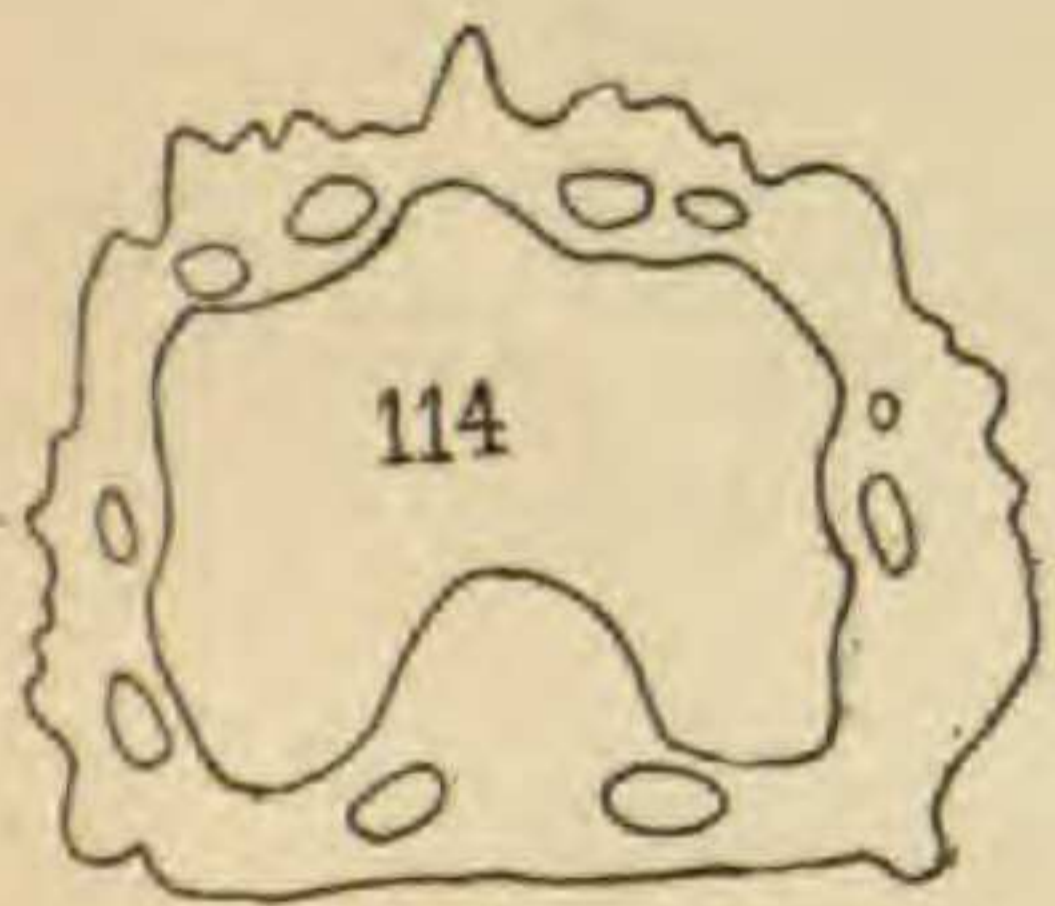
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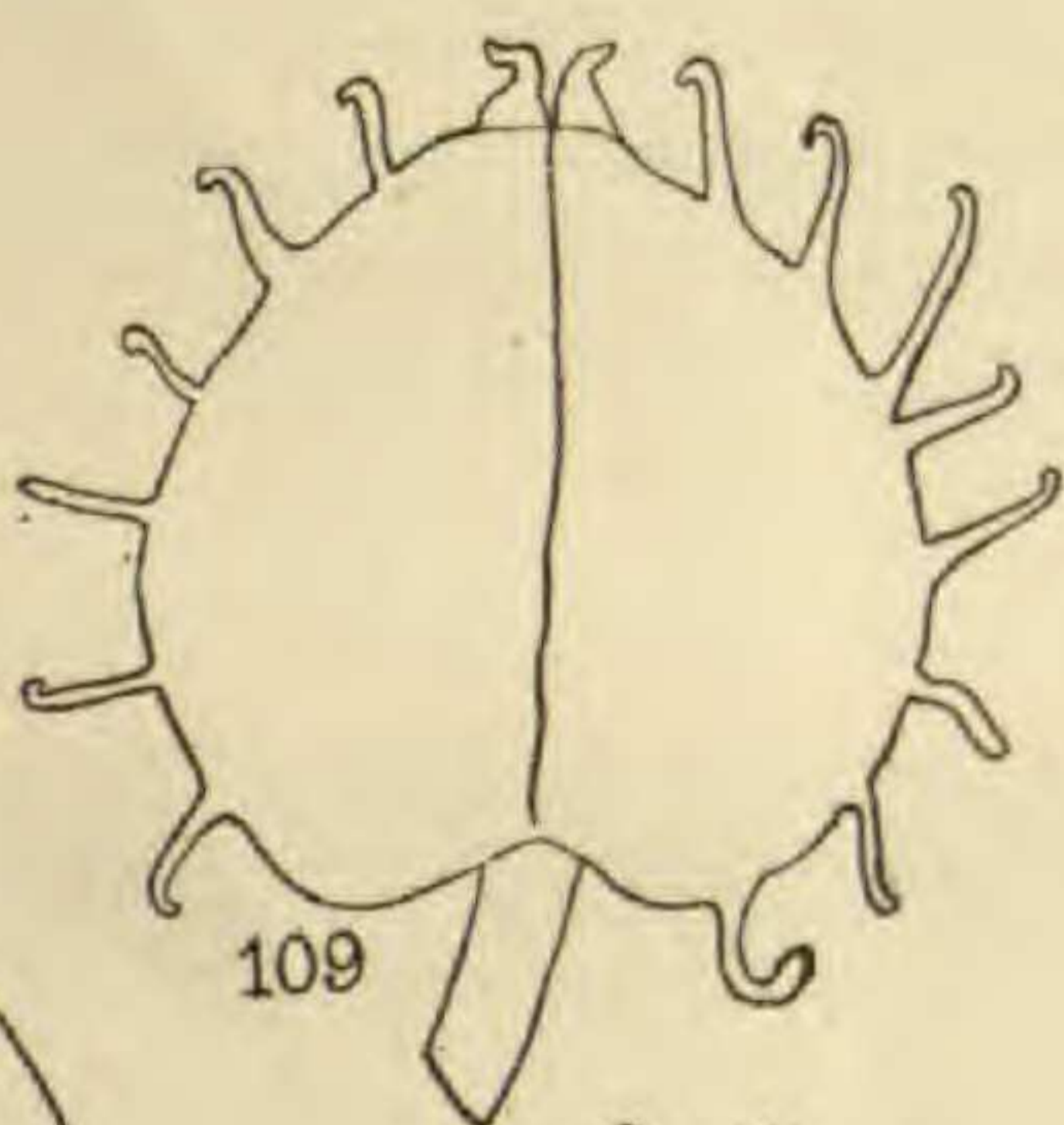
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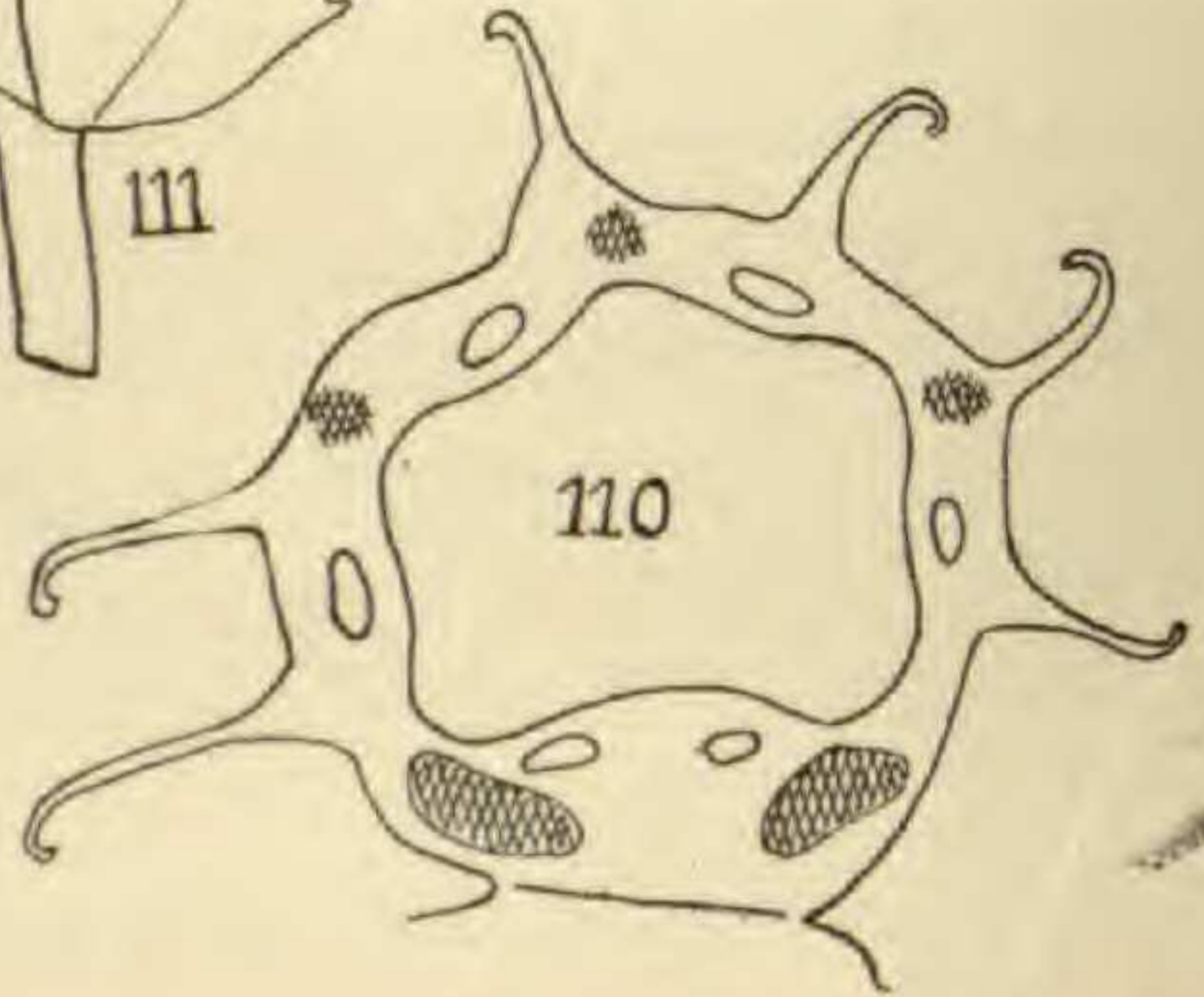
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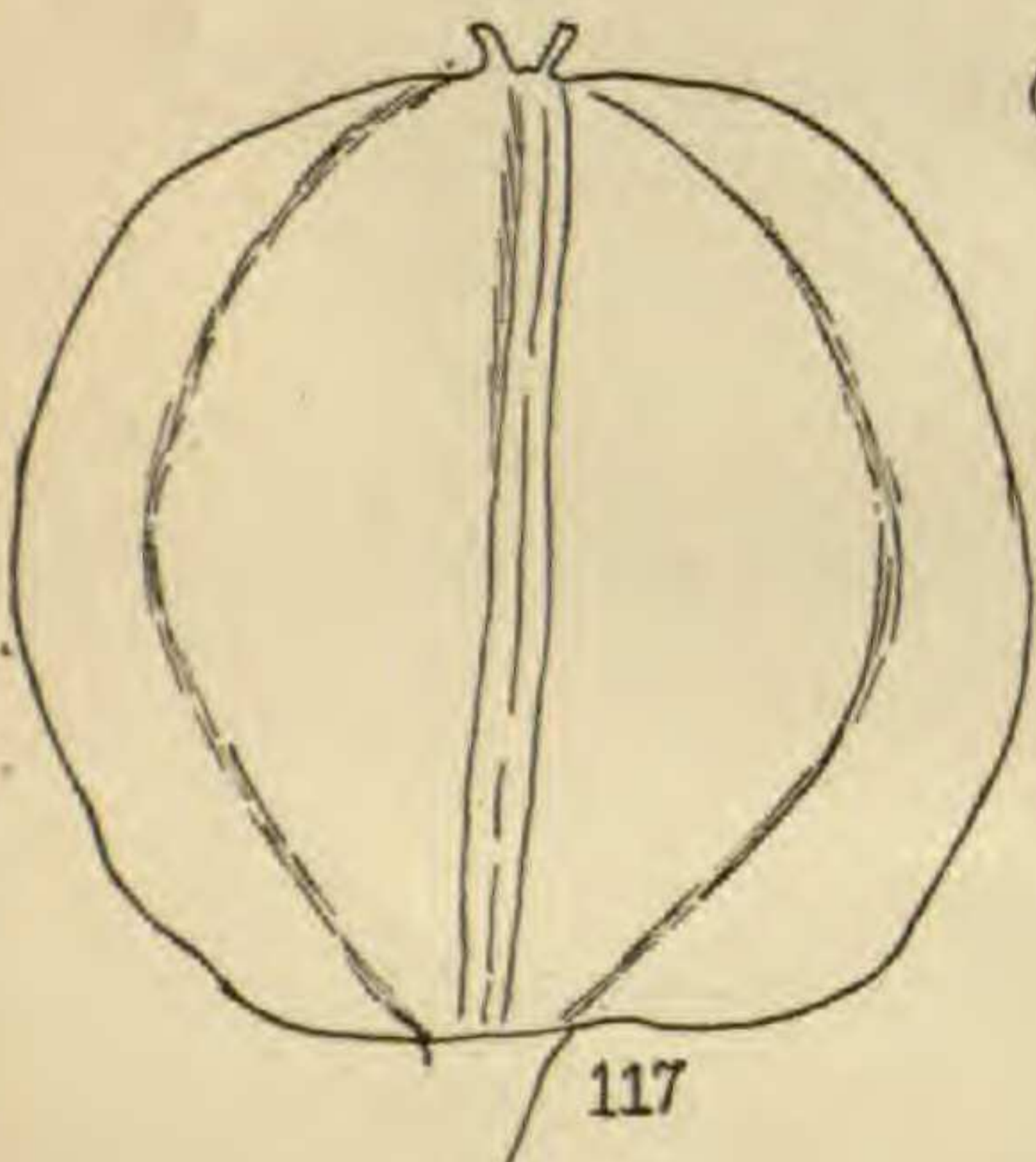
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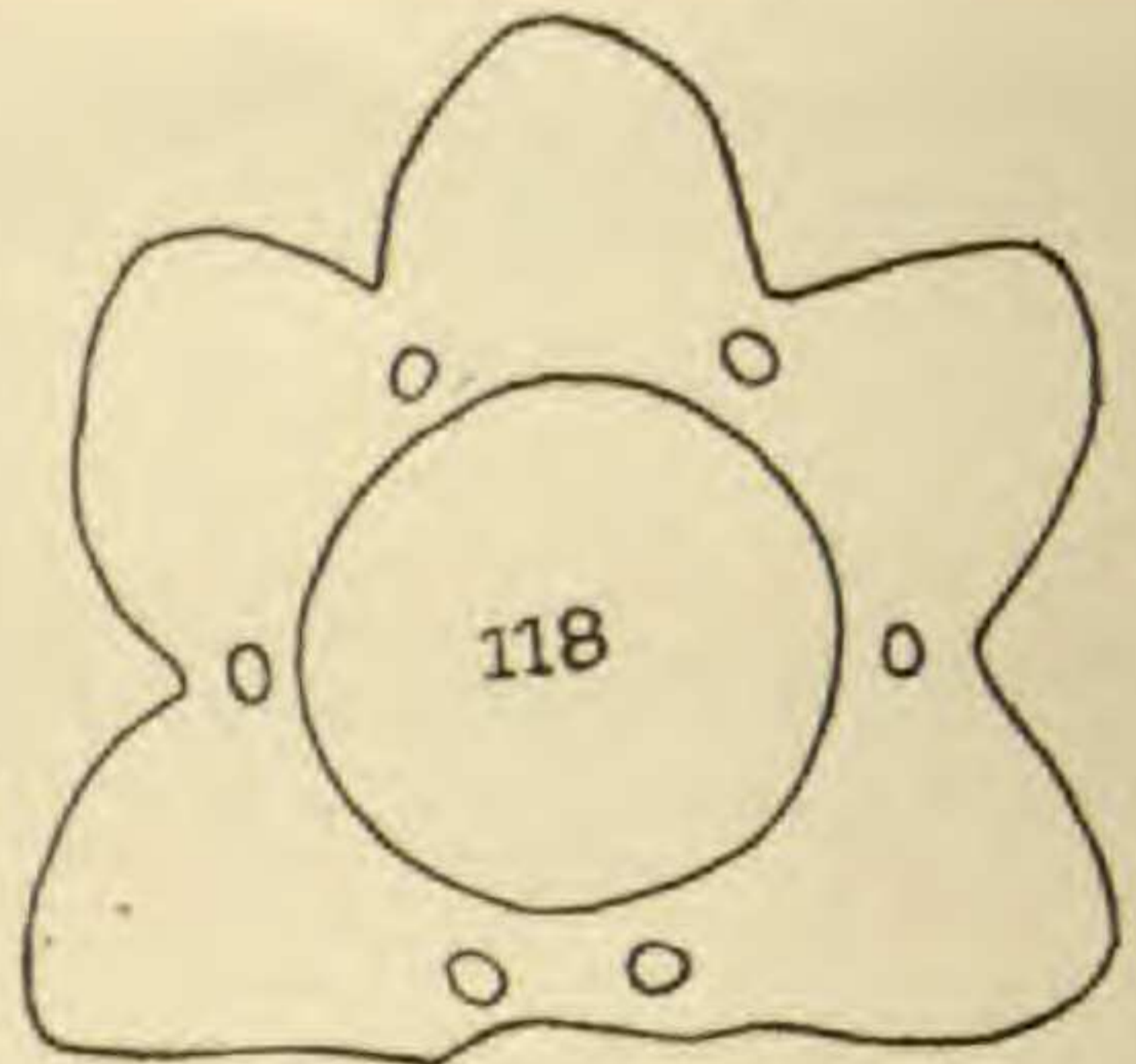
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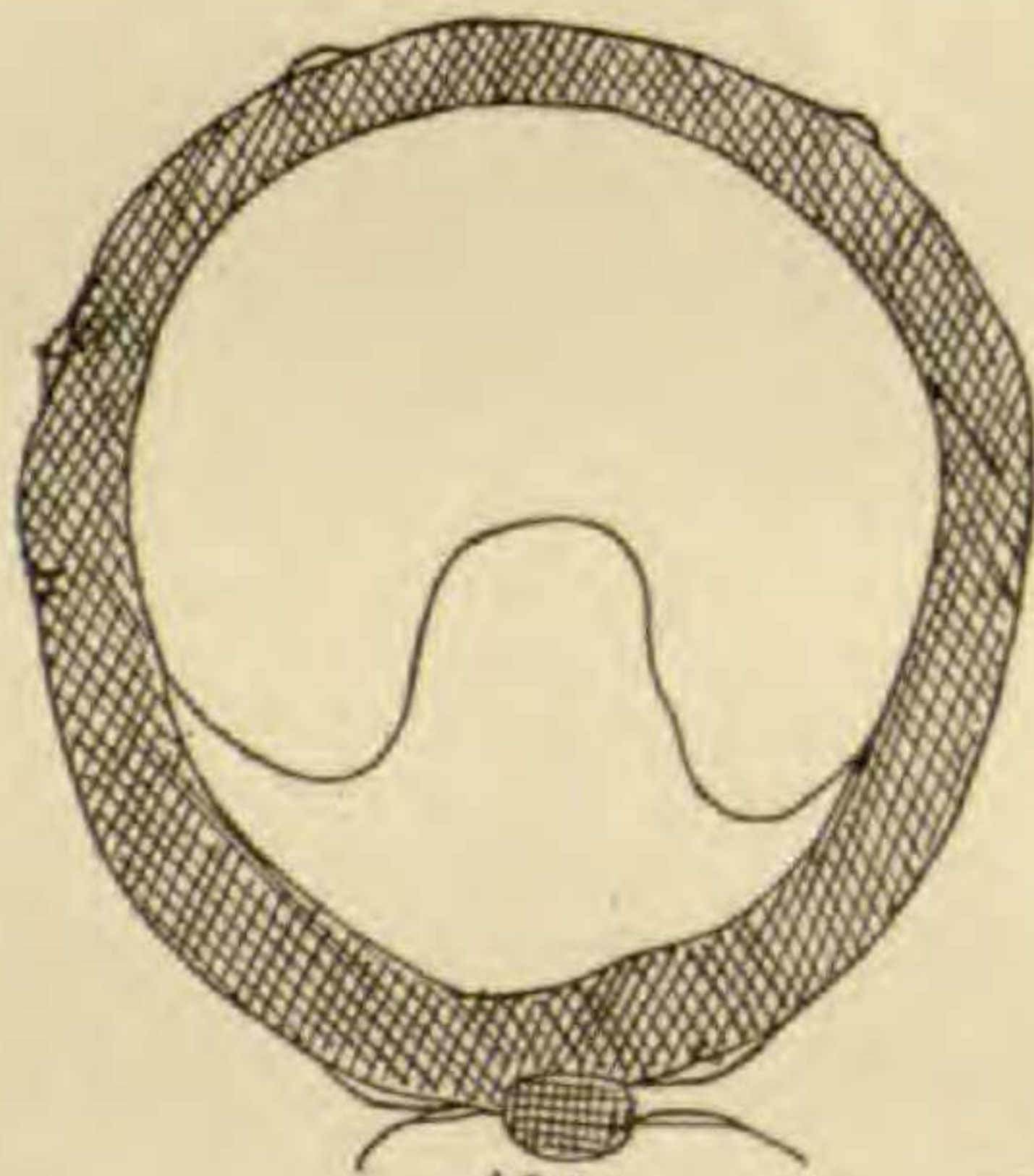
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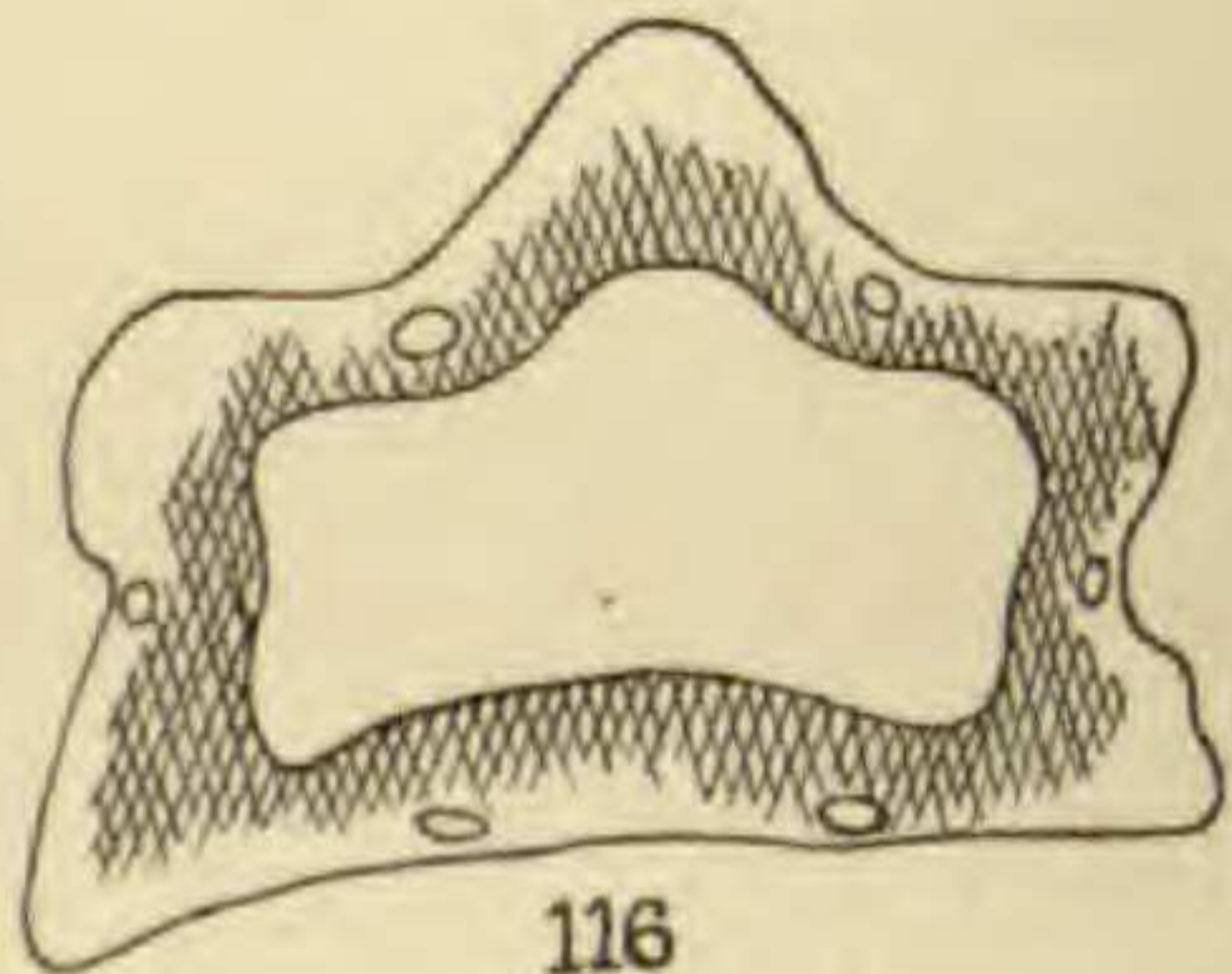
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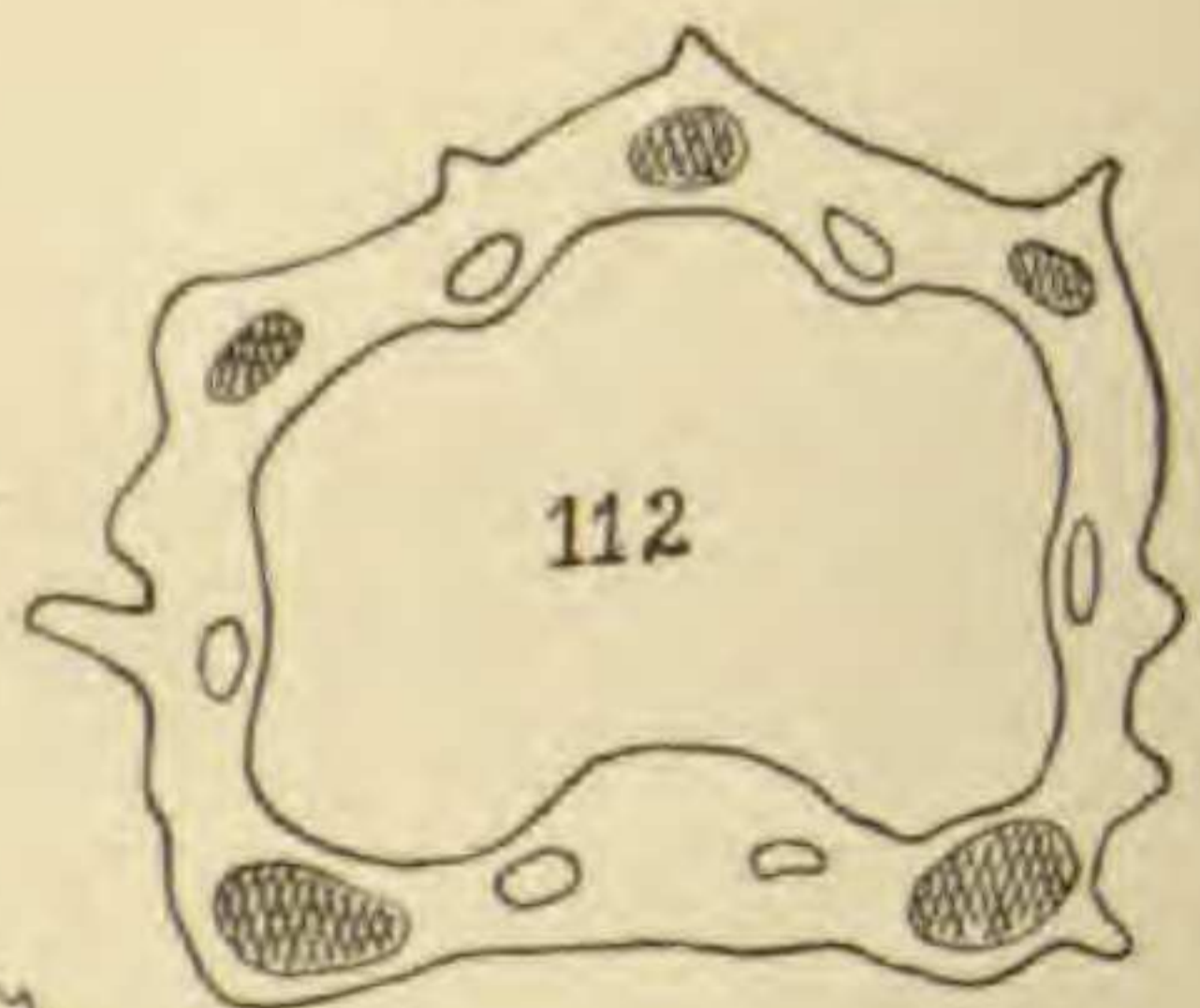
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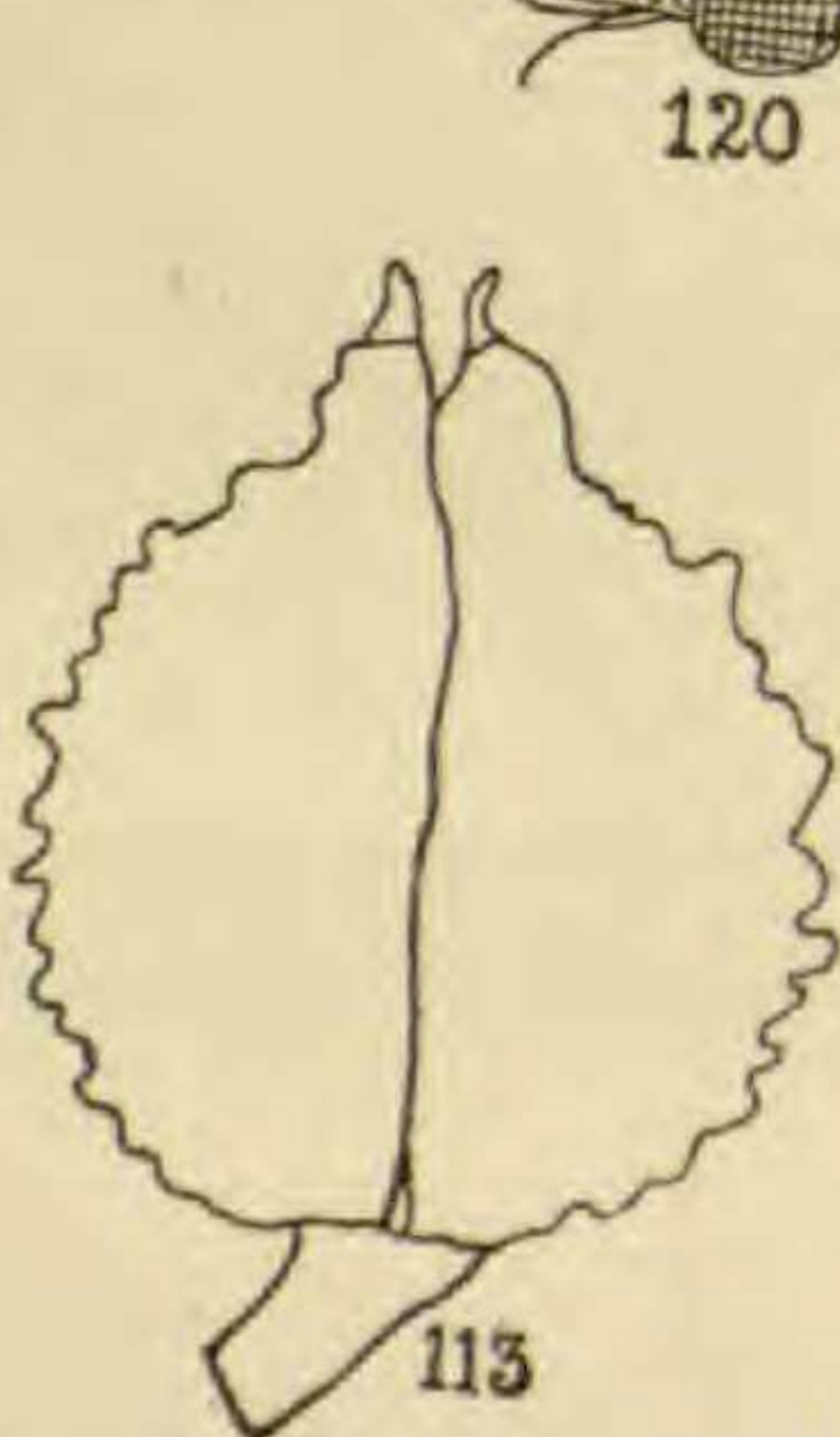
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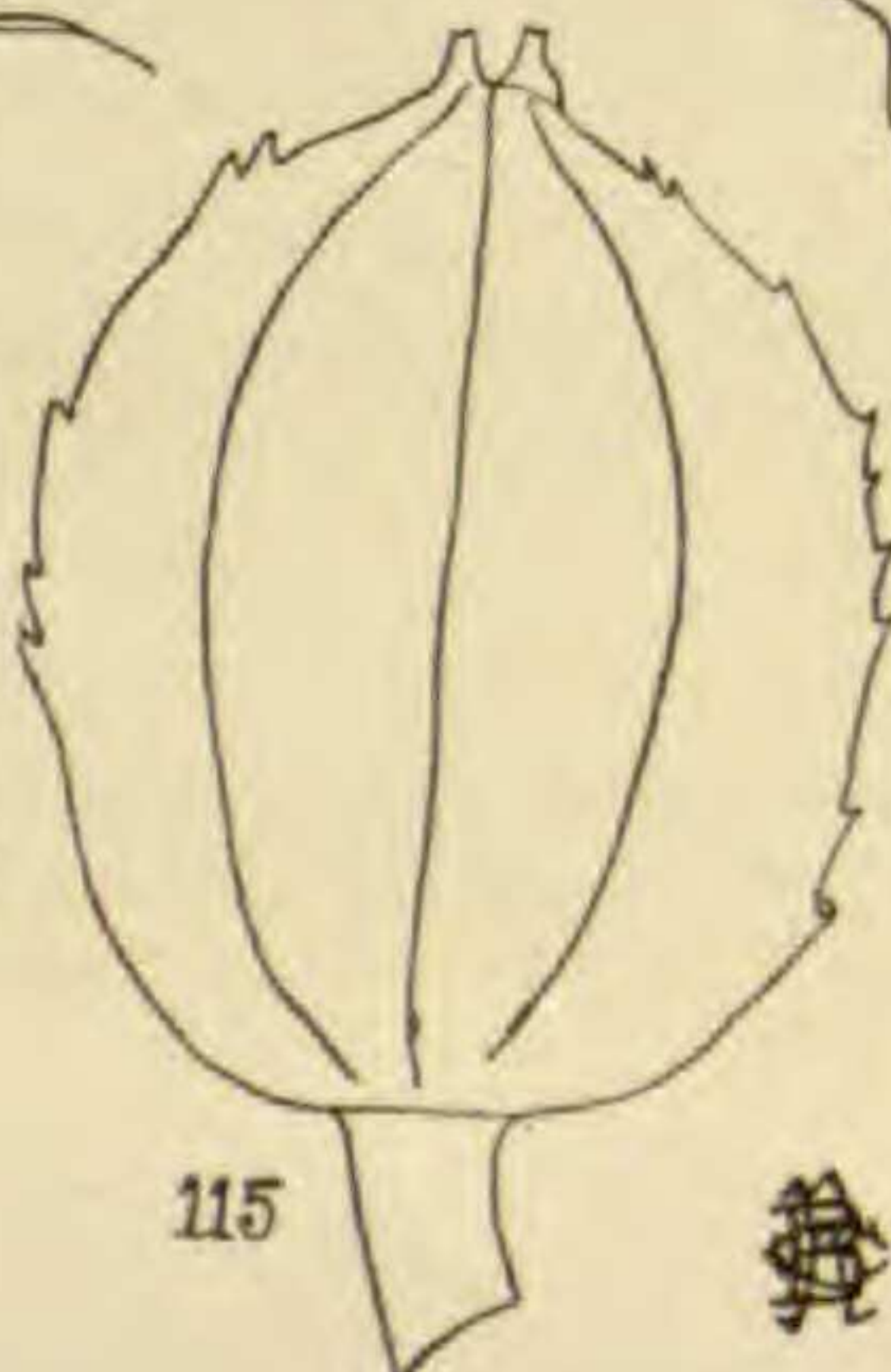
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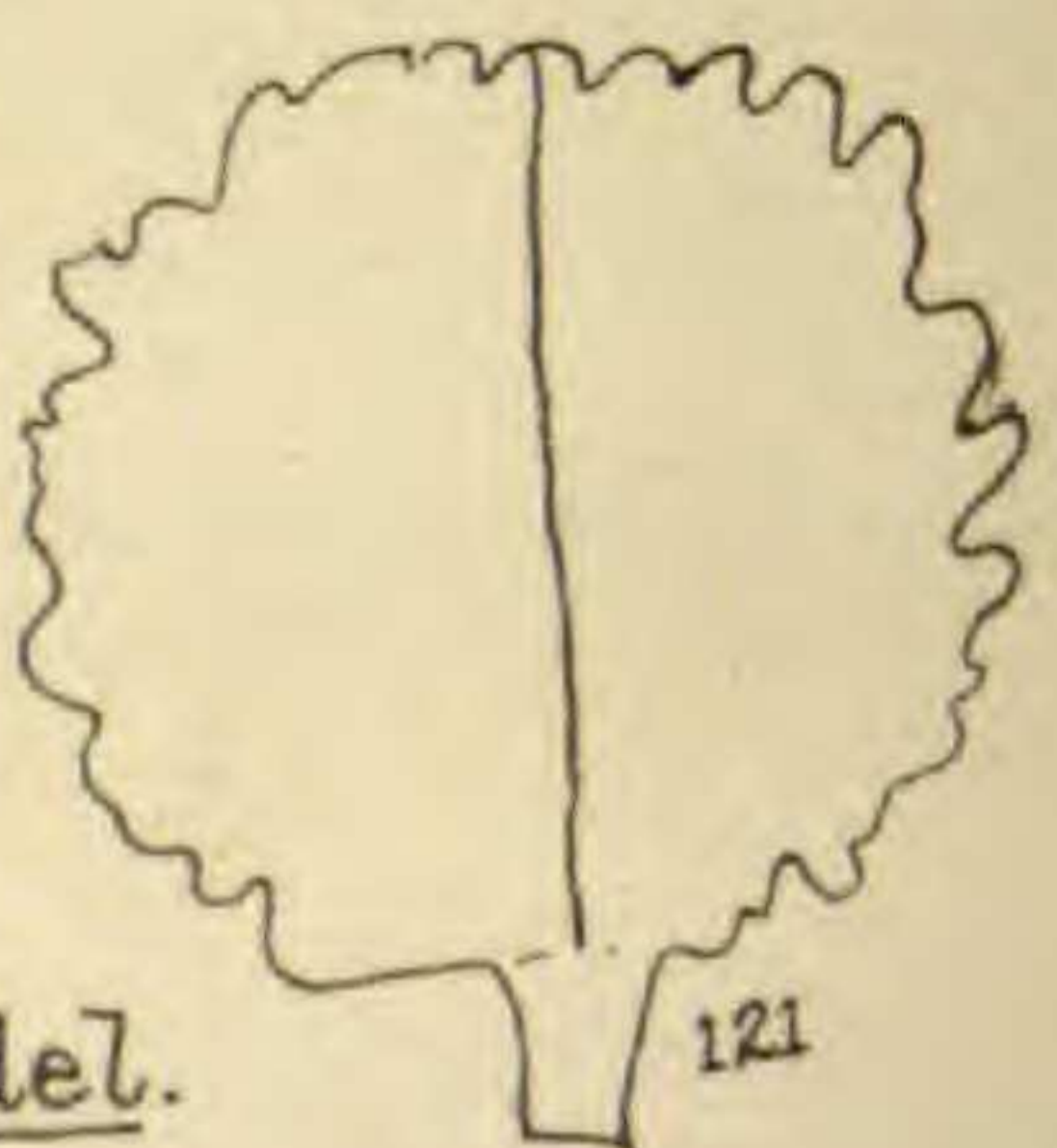


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